GALAPAGOS ISLANDS
ECUADOR
UPPER AIR STATION

Balloon release, San Cristobal, Galapagos GUAN Station

REPORT

HYDROGEN PLANT INSTALLATION

METEOROLOGICAL SERVICE OF NEW ZEALAND LIMITED

8 December 2004 *Vs 2*

TABLE OF CONTENTS

1 Summary

The GCOS Secretariat commissioned MetService to install a Proton Energies Hogen 20 hydrogen plant at San Cristobal, Galapagos Islands, Ecuador; to supply and install related items such as the water purifier, water and gas storage tanks, ancillary services, systems and infrastructure, and to provide training

This work was completed successfully during November 2004 and is reported on in detail in this document.

2 Background

Following MetService's site survey, GCOS Secretariat commissioned MetService to install a Proton Energies Hogen Hydrogen plant, provide some ancillary services, infrastructure and training at the GUAN station at San Cristobal, Galapagos Islands.

The Stuart Electrolyser Corporation M28 at the San Cristobal Office was installed about 1980, and, while still functioning, was reaching the end of its operational life. No spares of any kind were held. The original storage tank had not been tested since manufacture. It had therefore been decided to replace the system with a Proton Energy Systems Hogen 20 and New Zealand manufactured tanks. At the request of INAMHI, the M28 was retained as a back up, and the Hogen 20 installed as a stand alone unit.

This work was carried out between 4 and 13 November 2004 by Mr Bill Witham, a senior engineer with MetService, who has had extensive experience with upper air equipment in New Zealand and at Pacific Island stations, and is an expert on the Proton Hogen systems and related plant.

3 Programme of Work

The programme of work was:

- Install and commission a Proton Energies hydrogen generator that was procured by WMO and shipped directly to the site.
- Procure, ship and install any additional ancillary equipment that was required, or that would promote the operational sustainability of the system and that MetService had used on its installation as proposed in the site survey report..
- Coordinate and arrange with San Cristobal/INAMI staff for the required pre-installation work to be completed. Provide training (in English) on the new system to meteorological staff at San Cristobal and also an INAMHI engineer responsible for technically maintaining the system.

4 Installation

The installation comprised the following components:

4.1 Hogen 20

This was installed in the store room, adjacent to but separated by two doors from the balloon filling room, as per the drawing. The hydrogen vent was fed up the wall and through the roof. Oxygen and water drain lines were also fed out through holes in the wall.

AquaSolutions system, Proton Hogen 20, related plumbing and gas lines, and transformer after installation

4.2 AquaSolutions water purification system

Wall mounted in the corner of the store room, adjacent to the Hogen. To improve water storage capacity, a second RO storage tank was purchased. This however, arrived without a valve assembly, so was not installed at this time.

4.3 Power

Mains power regulation at the station was very poor, necessitating the use of a power transformer to convert 2 phase 110V (in practice 175V) to single phase 220V. This was installed on the floor next to the Hogen 20. A new power cable was installed from two new 40A circuit breakers on the main station switchboard, directly to the power transformer. The cable was enclosed in plastic tubing. Two earth stakes were driven, and these were bonded to the power transformer, the Hogen, and the storage tanks. An existing 110V circuit in the store room was extended to provide power to the AquaSolutions unit.

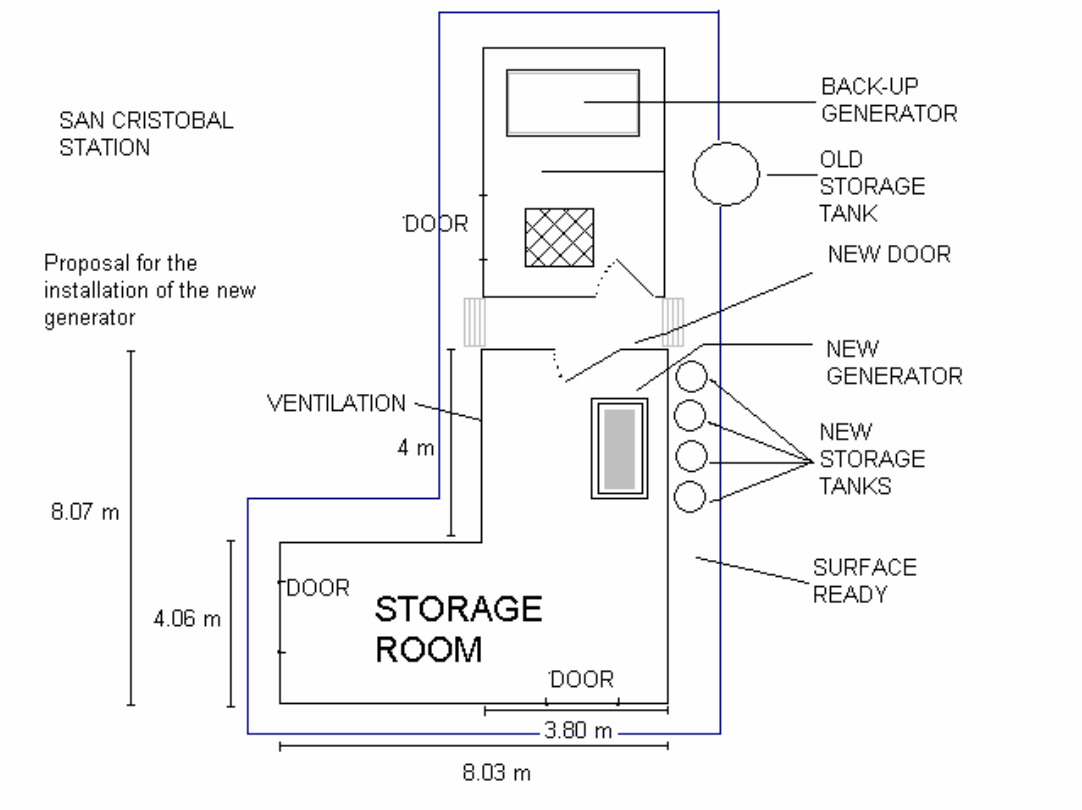
4.4 Tanks and hydrogen plumbing

Four new Niven 250 l tanks were positioned in line against the outside wall, and bolted down as per manufacturer's instructions. Because of surface damage that occurred to galvanising coating during shipping, tanks were painted.

Stainless steel Swagelock fittings and tubing were used to connect them together, back to the Hogen, and to the filling room. A Swagelock change over valve (centre off) was fitted between the M28 system, the Hogen, and the balloon filler.

The tanks were filled with water, and all joints tested for leaks at 200 psi before purging.

Tanks and plumbing installed, and cables and pipes covered by volcanic scree



4.5 Water

A new water line was installed from the station boost pump to a new outlet installed adjacent to the AquaSolutions unit.

5 Commissioning

Because of extensive delivery delays due customs clearance problems in Ecuador, the GC sensor was out of calibration. This was done before system could be started up. After purging of the storage tanks and leak testing, the system was run for approximately 26 hours to fill the tanks, with no problems.

At the request of Proton Energy Systems, system firmware was upgraded from 2.283 to 2.384. This resulted in an error E-35, invalid A300 state, which prevented the unit from running. After much consultation with Proton Energy staff, a previously undetectable faulty component in the A300 was identified. No spares were available, and since field repair was not possible, firmware revision 2.283 was reinstalled. Proton Energy is to supply a complete replacement A300 unit under warranty. The system is expected to perform normally in the short term even with the faulty unit.

6 Training

Extensive training was carried out with local staff, both during the installation and commissioning stages, and during semi formal sessions afterwards using training guides and manuals. Considerable time was spent in practical aspects, including problem identification, GC calibration, and module replacement. The Proton fault necessitated stripping the Hogen 20 down and this afforded additional practical training.

INAMHI staff receiving training

7 Documentation

The following equipment manuals were supplied

- AquaSolutions Model H-40-C Operating Manual
- Proton Energy Systems Hogen 20 Installation and Operating Manual
- Proton Energy Systems Hogen 20 Service Manual
- Proton Energy Systems Hogen 20 Maintenance Manual
- Proton Energy Systems Hogen 20 Training Guide

- Manufacturers data and test sheets for Niven tanks, Serial numbers 03140, 03141, 03146, 03147.
- Calibration Certificates tank pressure relief valves.

8 Spares and Tools

8.1 Spares

8.1.1 AquaSolutions Unit

The following spares have been supplied for the AquaSolutions unit:

Quan	Part Number	Description
1	TR-12VDC-2.5AM	12VDC TRANSFORMER 1---240V INPUT 50/60Hz
2	CR1812H1	RO REPLACEMENT CART 12" TFC
3	T-BU-4-4	BU - 1/4 TUBE BY 1/4 TUBE
3	T-PE-4-4	PE - 1/4 STEM BY 1/4 TUBE
20	PET-4 BLACK	1/4 OD BLACK POLY TUBING
20	PET-4 BLUE	1/4 OD BLUE POLY TUBING
20	PET-4 RED	1/4 OD RED POLY TUBING
1	PROTON H40-12V	RO+DI WATER SYST FOR PROTON ENERGY HOGEN 40 - INCL 2 PURIFICATION KITS
1	2613H40	PURIFICATION KIT FOR MODEL H40 RO+DI SYSTEM
2	CC1050	A/C PREFILTER CART 10" 5 MICRON
1	2000CP-12VDC	CIRCULATION PUMP 12VDC
1	RO-10-P-12VDC	RO FEED BOOSTER PUMP - 10 L/ 12VDC

8.1.2 Hogen 20

The following spares have been supplied for the Hogen 20:

Qty 1 - annual maintenance kit.

8.2 Tools

The following tools and test equipment were supplied:

- Set of screwdrivers
- Set of open end / ring wrenches
- Set of Hex keys
- Battery drill
- Clamp Amp / Volt meter
- Hand held combustible gas detector. (Supplied without special battery charger)

9 Other work

- Because of the nature of the ground, digging to bury the power and water lines would have been very difficult, if not impossible. It was decided that a few cubic metres of volcanic scree would be a good alternative, and provide some much needed landscaping.

Volcanic scree covering cables and water lines between office and hydrogen building; and providing landscaping

- Balloon shed door repair. Materials were purchased, and funds left with manager for payment for work when completed.

- No guttering was fitted to the balloon shed, so a small shelter was erected to protect the storage tanks from run off.

- Dust / insect screens were fitted to the up wind side of the store room.

- Funds ($100) were left with the manager for the purchase of a vacuum cleaner from Guayaquil (not available in San Cristobal).

10 Outstanding items

- Replacement A300 to be supplied by Proton under warranty. Defective module to be returned to Proton.
- Battery charger for hand held CG detector to be supplied by Proton.
- Valve assembly for RO storage tank to be supplied by AquaSolutions.

11 Points of contact

11.1 INAMHI – San Cristobal

- **Staff**

Officer in Charge:	Senor Mario Agama Reys
Staff:	Senor Jamie E. Corneso Poveda
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As during our previous visit to San Cristobal, Bill Witham, our engineer was made very welcome and provided with every assistance. We thank all of the staff of Instituto Nacional de Meteorologia E Hidrologia who assisted us to complete this project and for permitting us to be involved with their GUAN station.